

Claims

What is claimed is:

CR- 1317

1. A method for displaying an image only to an authorized user, comprising:
 - generating a data image;
 - generating a mask image, wherein the mask image is a negation of the data image;
 - selecting the data image or the mask image according to a select signal; and
 - sequentially displaying the selected images on a display device.
2. The method of claim 1 further comprising:
 - opening an optical shutter device when the data image is displayed;
 - shutting the optical shutter device when the mask image is displayed so that only the data image is perceived by the authorized user viewing the display device through the optical shutter device, and a gray image is perceived by an unauthorized user viewing the data and mask images directly, the opening and shutting synchronized in phase and frequency to the select signal.
3. The method of claim 2 wherein the optical shutter device includes a polarizing lens on either side of a ferro-electric liquid crystal polarization rotator.
4. The method of claim 2 further comprising:
 - synchronizing the displaying, and the opening and shutting by a wire link.

5. The method of claim 2 further comprising:
synchronizing the displaying, and the opening and shutting by a wireless link.
6. The method of claim 5 wherein the synchronization is according to a phase of the select signal.
7. The method of claim 1 wherein each image is a color image, and the negation is done independently for each color channel of the color image.
8. The method of claim 7 further comprising:
gamma-correcting each color channel after the negation.
9. The method of claim 7 wherein each input pixel of each color image has an intensity in a range from 0 to 255, and each output pixel is determined by:
$$\text{output} = 255((\text{input}/255)^{1/\gamma}) + 0.5.$$
10. The method of claim 1 wherein the select signal is generated by a clock, and further comprising:
alternately selecting the data and mask images according to clock cycles.
11. The method of claim 1 wherein the select signal is generated by a random generator.
12. The method of claim 11 wherein the displayed images occur in pairs so that each pair includes the first image and the second image in a random order.

13. The method of claim 11 wherein the random generator operates according to an internal seed value and a real-time supplied value.

14. The method of claim 2 further comprising:

generating a first random select signal to select the displayed images;

generating a second random select signal to open and shut the optical shutter device; and

synchronizing the second ransom select signal to the first and select signal.

15. The method of claim 1 wherein each data image includes a plurality of pixels, and further comprising:

negating each pixel of the data image serially to generate each corresponding pixel of the mask image; and

serially selecting each pixel of the data image or the mask image according to a select signal; and

sequentially displaying the selected pixels on a display device.

16. The method of claim 15 further comprising:

opening an optical shutter device when the selected pixel of the data image is displayed;

shutting the optical shutter device when the selected pixel of the mask image is displayed so that only the data image is perceived by the authorized user viewing the display device through the optical shutter device, and a gray image is perceived by an unauthorized user viewing the data and mask images directly, the opening and shutting synchronized in phase and frequency to the select signal.

17. The method of claim 16 wherein the select signal is generated by a clock, and further comprising:

alternately selecting the pixel from the data and the pixel from the mask images according to clock cycles.

18. The method of claim 1 wherein the select signal is generated by a random generator.

19. The method of claim 1 wherein a plurality of data images are provided in a video, and each data image is sequentially negated to produce the corresponding mask image.

20. A method for displaying an image only to an authorized user, comprising:

generating a data image;

generating a mask image, wherein the mask image is a combination of the data image and a public image;

selecting the data image or the mask image according to a select signal; and sequentially displaying the selected images on a display device.

21. The method of claim 20 wherein the data image P is scaled and off-set according to $\alpha P + A$, where α and A are first scaling and -offset parameters, and wherein a secret image is scaled and off-set according to β and B , where β and B are second scaling and -offset parameters, and wherein the combining adds the scaled and off-set data and secret images to produce the mask image.

22. The method of claim 21 wherein the first and second scaled and off-set parameters are constrained to inequalities $\alpha + \beta \leq 1$, and $\alpha + A \leq B$.

23. The method of claim 20 further comprising;

opening an optical shutter device when the data image is displayed;
shutting the optical shutter device when the mask image is displayed so that only the data image is perceived by the authorized user viewing the display device through the optical shutter device, and a gray image is perceived by an unauthorized user viewing the data and mask images directly, the opening and shutting synchronized in phase and frequency to the select signal.

24. The method of claim 20 wherein the select signal is generated by a clock, and further comprising:

alternately selecting the data and mask images according to clock cycles.

25. An apparatus for displaying an image only to an authorized user, comprising:

a video camera generating a data image;

an inverter for generating a mask image, wherein the mask image is a negation of the data image;

a controller generating a select signal for selecting the data image or the mask image; and

a display device for sequentially displaying selected images on a display device.

26. The apparatus of claim 25 further comprising:

an optical shutter device opened when the data image is displayed and closed when the mask image is displayed so that only the data image is perceived by the authorized user viewing the display device through the optical shutter device, and a gray image is perceived by an unauthorized user viewing the data and mask images directly, the opening and shutting of the optical shutter device synchronized in phase and frequency to the select signal.

27. The apparatus of claim 25 wherein the data and mask images are selected periodically.

28. The apparatus of claim 25 wherein the data and mask images are selected randomly.

29. The apparatus of claim 25 wherein the 25 wherein each image includes a plurality of pixels, and wherein each pixel of the data image negated serially.